

Amendments to the Claims:

This listing of Claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A silicon carbide metal-oxide semiconductor field effect transistor unit cell, comprising:

an n-type silicon carbide drift layer;
a first p-type silicon carbide region adjacent in close proximity to the drift layer;
a first n-type silicon carbide region within the first p-type silicon carbide region;
an oxide layer on the drift layer, the first p-type silicon carbide region, and the first n-type silicon carbide region; and

an n-type silicon carbide limiting region disposed between the drift layer and a portion of the first p-type silicon carbide region, wherein the n-type limiting region comprises a first portion disposed in close proximity to a floor of the first p-type silicon carbide region and a second portion disposed in close proximity to a sidewall of the first p-type silicon carbide region, wherein the n-type limiting region has a carrier concentration that is greater than a carrier concentration of the drift layer and wherein the first portion has a carrier concentration greater than a carrier concentration of the second portion.

2-4. (Canceled).

5. (Original) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 1, wherein the first p-type silicon carbide region is implanted with aluminum.

6. (Original) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 1, further comprising:

a gate contact on the oxide layer;
a source contact on the first n-type silicon carbide region; and
a drain contact on the drift layer opposite the oxide layer.

7. (Original) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 1, wherein the n-type limiting region comprises an epitaxial layer of silicon carbide on the n-type silicon carbide drift layer.

8. (Original) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 7, wherein the first p-type region is disposed in but not through the epitaxial layer of silicon carbide.

9. (Original) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 1, wherein the n-type limiting region has a thickness of from about 0.5 μm to about 1.5 μm and a carrier concentration of from about 1×10^{15} to about $5 \times 10^{17} \text{ cm}^{-3}$.

10. (Original) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 6, wherein the gate contact comprises polysilicon or metal.

11. (Currently Amended) A silicon carbide metal-oxide semiconductor field effect transistor unit cell ~~according to Claim 1, further comprising:~~

an n-type silicon carbide drift layer;
a first p-type silicon carbide region adjacent the drift layer;
a first n-type silicon carbide region within the first p-type silicon carbide region;
an oxide layer on the drift layer, the first p-type silicon carbide region, and the first n-type silicon carbide region;
an n-type silicon carbide limiting region disposed between the drift layer and a portion of the first p-type silicon carbide region, wherein the n-type limiting region has a carrier concentration that is greater than a carrier concentration of the drift layer; and
an n-type epitaxial layer on the first p-type silicon carbide region and a portion of the first n-type region, and disposed between the first n-type silicon carbide region and the first p-type silicon carbide region and the oxide layer.

12. (Original) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 1, wherein the n-type limiting region comprises an implanted n-type region in the drift layer.

13. (Original) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 6, further comprising an n-type silicon carbide substrate disposed between the drift layer and the drain contact.

14. (Original) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 1, further comprising a second p-type silicon carbide region disposed within the first p-type silicon carbide region and adjacent the first n-type silicon carbide region.

15. (Currently Amended) A silicon carbide metal-oxide semiconductor field effect transistor, comprising:

a drift layer of n-type silicon carbide;

first regions of p-type silicon carbide adjacent in close proximity to the drift layer;

a first region of n-type silicon carbide disposed between peripheral edges of the first regions of p-type silicon carbide;

second regions of n-type silicon carbide within the first regions of p-type silicon carbide, wherein the second regions of n-type silicon carbide have a carrier concentration greater than a carrier concentration of the drift layer and are spaced apart from the peripheral edges of the first regions of p-type silicon carbide;

an oxide layer on the drift layer, the first region of n-type silicon carbide and the second regions of n-type silicon carbide;

third regions of n-type silicon carbide disposed beneath the first regions of p-type silicon carbide and between the first regions of p-type silicon carbide and the drift layer, wherein the third regions of n-type silicon carbide have a carrier concentration greater than the carrier concentration of the drift layer, and wherein the first region of n-type silicon carbide has a higher carrier concentration than a carrier concentration of the drift layer and

has a lower carrier concentration than the carrier concentration of the third regions of n-type silicon carbide;

source contacts on portions of the second regions of n-type silicon carbide;
a gate contact on the oxide layer; and
a drain contact on the drift layer opposite the oxide layer.

16. (Original) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 15, wherein the third regions of n-type silicon carbide are adjacent the peripheral edges of the first regions of p-type silicon carbide.

17. (Original) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 15, wherein the first region of n-type silicon carbide and the third regions of n-type silicon carbide comprise an n-type silicon carbide epitaxial layer on the drift layer, and wherein the first regions of p-type silicon carbide are formed in the n-type silicon carbide epitaxial layer.

18. (Original) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 15, wherein the first region of n-type silicon carbide comprises a region of the drift layer.

19. (Original) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 18, wherein the third regions of n-type silicon carbide comprise implanted n-type regions in the drift layer.

20. (Canceled).

21. (Currently Amended) A silicon carbide metal-oxide semiconductor field effect transistor ~~according to Claim 15, further comprising:~~
a drift layer of n-type silicon carbide;
first regions of p-type silicon carbide adjacent the drift layer;

a first region of n-type silicon carbide disposed between peripheral edges of the first regions of p-type silicon carbide;

second regions of n-type silicon carbide within the first regions of p-type silicon carbide, wherein the second regions of n-type silicon carbide have a carrier concentration greater than a carrier concentration of the drift layer and are spaced apart from the peripheral edges of the first regions of p-type silicon carbide;

an n-type epitaxial layer of silicon carbide on the first p-type regions and the first region of n-type silicon carbide;

an oxide layer on the drift layer, the first region of n-type silicon carbide and the second regions of n-type silicon carbide;

third regions of n-type silicon carbide disposed beneath the first regions of p-type silicon carbide and between the first regions of p-type silicon carbide and the drift layer, wherein the third regions of n-type silicon carbide have a carrier concentration greater than the carrier concentration of the drift layer;

source contacts on portions of the second regions of n-type silicon carbide;

a gate contact on the oxide layer; and

a drain contact on the drift layer opposite the oxide layer.

22. (Original) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 15, further comprising an n-type silicon carbide layer between the drift layer and the drain contact, wherein the n-type silicon carbide layer has a higher carrier concentration than the carrier concentration of the drift layer.

23. (Original) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 22, wherein the n-type silicon carbide layer comprises an n-type silicon carbide substrate.

24. (Original) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 15, further comprising second p-type silicon carbide regions disposed within the first p-type silicon carbide regions.

25. (Original) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 15, wherein the third regions of n-type silicon carbide have a thickness of from about 0.5 μm to about 1.5 μm .

26. (Original) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 15, wherein the third regions of n-type silicon carbide have a carrier concentration of from about 1×10^{15} to about $5 \times 10^{17} \text{ cm}^{-3}$.

27. (Currently Amended) A silicon carbide metal-oxide semiconductor field effect transistor comprising:

an n-type silicon carbide drift layer; --
spaced apart p-type silicon carbide well regions; and

an n-type silicon carbide limiting region disposed between the well regions and the drift layer, wherein the n-type limiting region comprises a first portion disposed in close proximity to respective floors of the well regions and a second portion disposed in close proximity to respective sidewalls of the well regions, and wherein the first portion has a carrier concentration greater than a carrier concentration of the second portion.

28. (Canceled).

29. (Original) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 27, wherein the n-type limiting region has a carrier concentration higher than a carrier concentration of the drift layer.

30. (Original) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 27, wherein the n-type limiting region comprises an epitaxial layer of silicon carbide on the drift layer, and wherein the p-type well regions are disposed in but not through the epitaxial layer.

31. – 60. (Canceled).

61. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell, comprising:

- an n-type silicon carbide drift layer;
- a first p-type silicon carbide region having a floor and a sidewall, wherein the drift layer is in close proximity to the floor and the sidewall of the first p-type silicon carbide region;
- a first n-type silicon carbide region within the first p-type silicon carbide region;
- an oxide layer on the drift layer, the first p-type silicon carbide region, and the first n-type silicon carbide region; and
- an n-type silicon carbide limiting region disposed between the drift layer and the floor of the first p-type silicon carbide region, wherein the n-type limiting region has a carrier concentration that is greater than a carrier concentration of the drift layer.

62. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 61, wherein the n-type limiting region is further disposed adjacent the sidewall of the first p-type silicon carbide region.

63. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 61, wherein the n-type limiting region comprises a first portion disposed adjacent the floor of the first p-type silicon carbide region and a second portion disposed adjacent the sidewall of the first p-type silicon carbide region, and wherein the first portion has a carrier concentration greater than a carrier concentration of the second portion.

64. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 61, wherein the first p-type silicon carbide region is implanted with aluminum.

65. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 61, further comprising:

- a gate contact on the oxide layer;
- a source contact on the first n-type silicon carbide region; and

a drain contact on the drift layer opposite the oxide layer.

66. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 61, wherein the n-type limiting region comprises an epitaxial layer of silicon carbide on the n-type silicon carbide drift layer.

67. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 66, wherein the first p-type region is disposed in but not through the epitaxial layer of silicon carbide.

68. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 61, wherein the n-type limiting region has a thickness of from about 0.5 μ m to about 1.5 μ m and a carrier concentration of from about 1×10^{15} to about 5×10^{17} cm^{-3} .

69. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 68, wherein the gate contact comprises polysilicon or metal.

70. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 61, further comprising an n-type epitaxial layer on the first p-type silicon carbide region and a portion of the first n-type region, wherein the n-type epitaxial layer is disposed between the first n-type silicon carbide region and the oxide layer and between the first p-type silicon carbide region and the oxide layer.

71. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 61, wherein the n-type limiting region comprises an implanted n-type region in the drift layer.

72. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 65, further comprising an n-type silicon carbide substrate disposed between the drift layer and the drain contact.

73. (New) A silicon carbide metal-oxide semiconductor field effect transistor unit cell according to Claim 61, further comprising a second p-type silicon carbide region disposed within the first p-type silicon carbide region and adjacent the first n-type silicon carbide region.

74. (New) A silicon carbide metal-oxide semiconductor field effect transistor, comprising:

a drift layer of n-type silicon carbide;

first regions of p-type silicon carbide in close proximity to the drift layer so that a first region of the drift layer is disposed between peripheral edges of the first regions of p-type silicon carbide;

second regions of n-type silicon carbide within the first regions of p-type silicon carbide, wherein the second regions of n-type silicon carbide have a carrier concentration greater than a carrier concentration of the drift layer and are spaced apart from the peripheral edges of the first regions of p-type silicon carbide;

an oxide layer on the drift layer, the first region of the drift layer, and the second regions of n-type silicon carbide;

third regions of n-type silicon carbide disposed beneath the first regions of p-type silicon carbide and between the first regions of p-type silicon carbide and the drift layer, wherein the third regions of n-type silicon carbide have a carrier concentration greater than the carrier concentration of the drift layer;

source contacts on portions of the second regions of n-type silicon carbide;

a gate contact on the oxide layer; and

a drain contact on the drift layer opposite the oxide layer.

75. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 74, wherein the third regions of n-type silicon carbide are adjacent the peripheral edges of the first regions of p-type silicon carbide.

76. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 74, wherein the third regions of n-type silicon carbide comprise an n-type silicon carbide epitaxial layer on the drift layer, and wherein the first regions of p-type silicon carbide are formed in the n-type silicon carbide epitaxial layer.

77. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 74, wherein the third regions of n-type silicon carbide comprise implanted n-type regions in the drift layer.

78. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 74, further comprising an n-type epitaxial layer of silicon carbide on the first p-type regions and the first region of the drift layer.

79. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 74, further comprising an n-type silicon carbide layer between the drift layer and the drain contact, wherein the n-type silicon carbide layer has a higher carrier concentration than the carrier concentration of the drift layer.

80. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 79, wherein the n-type silicon carbide layer comprises an n-type silicon carbide substrate.

81. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 74, further comprising second p-type silicon carbide regions disposed within the first p-type silicon carbide regions.

82. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 74, wherein the third regions of n-type silicon carbide have a thickness of from about 0.5 μ m to about 1.5 μ m.

83. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 74, wherein the third regions of n-type silicon carbide have a carrier concentration of from about 1×10^{15} to about 5×10^{17} cm⁻³.

84. (New) A silicon carbide metal-oxide semiconductor field effect transistor comprising:

an n-type silicon carbide drift layer;

spaced apart p-type silicon carbide well regions having respective floors and sidewalls, wherein the drift layer is disposed between the respective sidewalls of the well regions; and

n-type silicon carbide limiting regions disposed between the respective floors of the well regions and the drift layer.

85. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 84, wherein the n-type limiting regions are further disposed between the respective sidewalls of the spaced apart p-type well regions.

86. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 84, wherein the n-type limiting regions have a carrier concentration higher than a carrier concentration of the drift layer.

87. (New) A silicon carbide metal-oxide semiconductor field effect transistor according to Claim 84, wherein the n-type limiting regions respectively comprise an epitaxial layer of silicon carbide on the drift layer, and wherein the p-type well regions are respectively disposed in but not through the epitaxial layer.